Navy Vapor Intrusion Evaluation Tool

EMDQ 2012 Workshop

Donna Caldwell
NAVFAC Atlantic

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Why Navy Developed VI Evaluation Tool

- 116 potential VI sites across Navy
  - ~ 85% chlorinated groundwater plumes
  - ~ 28% NAPL present
  - ~ 75% of the sites for current buildings

- Consistent and efficient VI evaluations in Restoration Program

- VI information overload and variability in VI guidance
  - Break information into manageable components
  - Customize the information for conceptual site model (CSM)

EPA Web Site, Workshops, Presentations

2002	2008
OSWER Draft Guidance for Evaluating the VI	U.S. EPA's Vapor Intrusion Database

2010	R5 2010
Review of EPA Draft VI Guidance	EPA/NOAA VI Guidebook

ITRC, DoD, State, VI Conferences, Literature

| ITRC VI Pathway: A Practical Guideline	DoD Vapor Intrusion Handbook Jan. 2009	Guidance Evaluating VI New York Oct. 2006
VI Guidance, New Jersey Oct. 2006	AWMA VI Conference, Sep. 2010	*NAVFAC Background Guidance VI*

Why Navy Developed VI Evaluation Tool

- Understand and manage VI challenges
    - Spatial/temporal variability of data
    - Background sources (indoor and outdoor)
    - Determining the significance of the evidence

- Document VI decision process

- Provide one-stop shopping VI resource

- Track magnitude of Navy VI impacts & costs
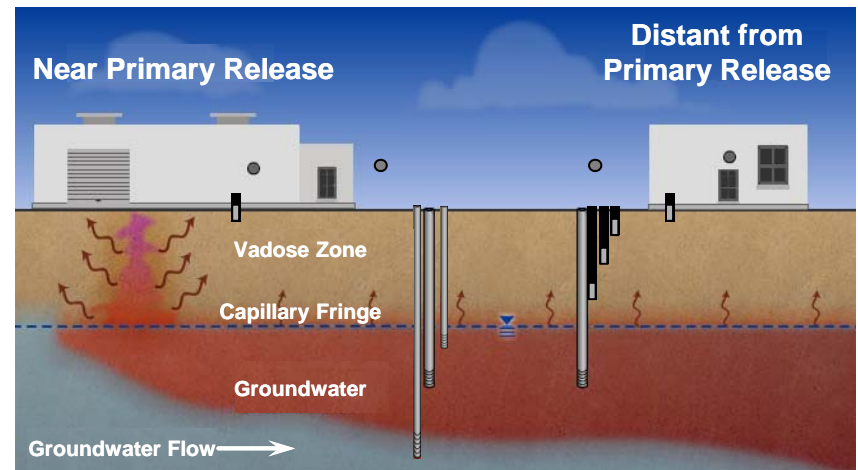
Why Navy Developed VI Evaluation Tool

- Understand strength and weakness of multiple lines of evidence

- Not all lines of evidence are created equal

- Strength of evidence depends on CSM
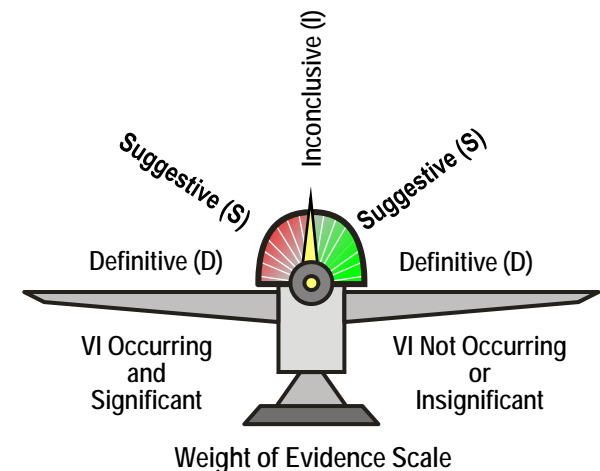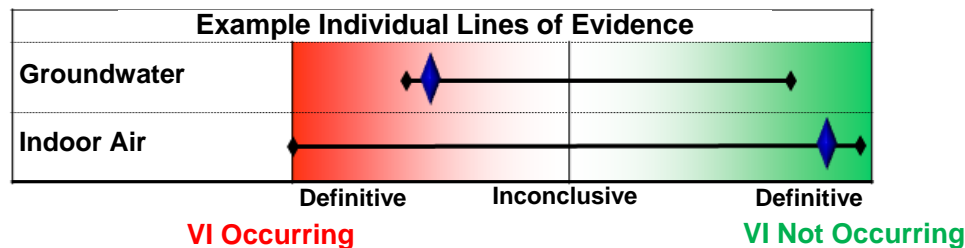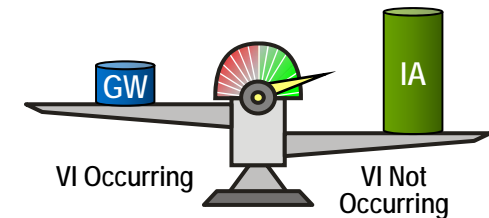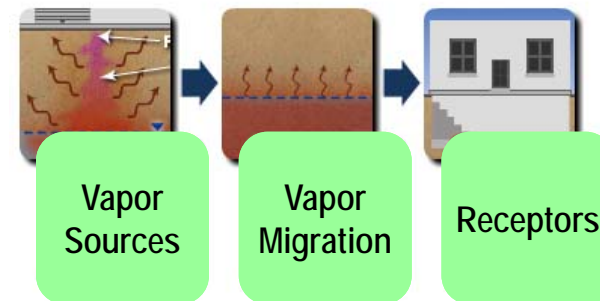
Conceptual Site Model

- Vapor sources
  - Presence/absence of non-aqueous-phase liquid (NAPL)
  - Composition, concentration, and distribution

- Factors Controlling Migration
  - Building characteristics
  - Lithology/hydrogeology
  - Source strength and distance to building/receptor
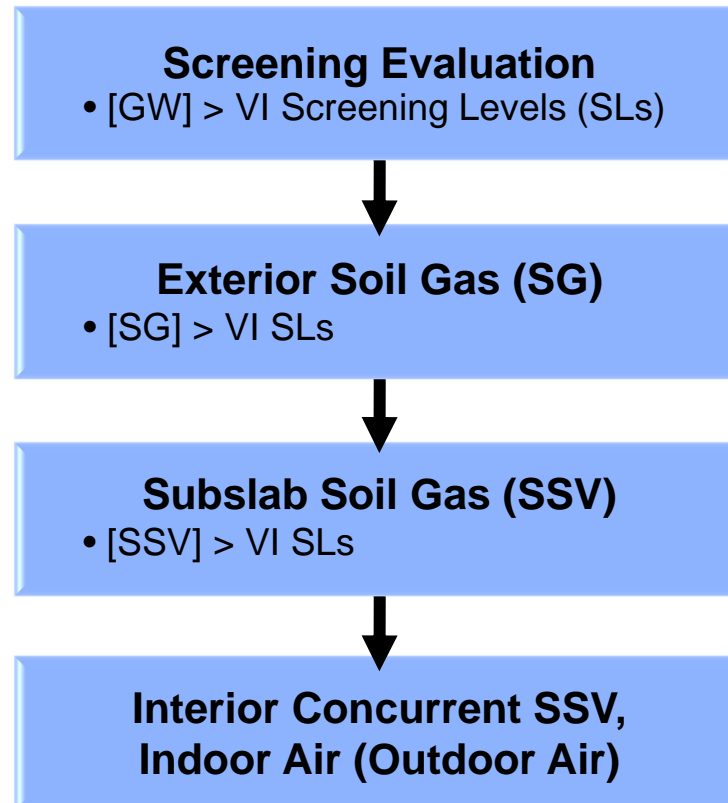
- Receptors
  - Current / future
  - Residential / Industrial

Vapor Sources → Vapor Migration → Receptors

Primary Source-to-Building Distance

Free Phase TCE
Sorbed TCE

Dissolved TCE

Evolution of the VI Practice Ahead of Guidance

Typical Guidance 2002
Linear (flow chart) Approach

- Sequentially Evaluate Single Lines of Evidence

Screening Evaluation
- [GW] > VI Screening Levels (SLs)

↓

Exterior Soil Gas (SG)
- [SG] > VI SLs

↓

Subslab Soil Gas (SSV)
- [SSV] > VI SLs

↓

Interior Concurrent SSV, Indoor Air (Outdoor Air)
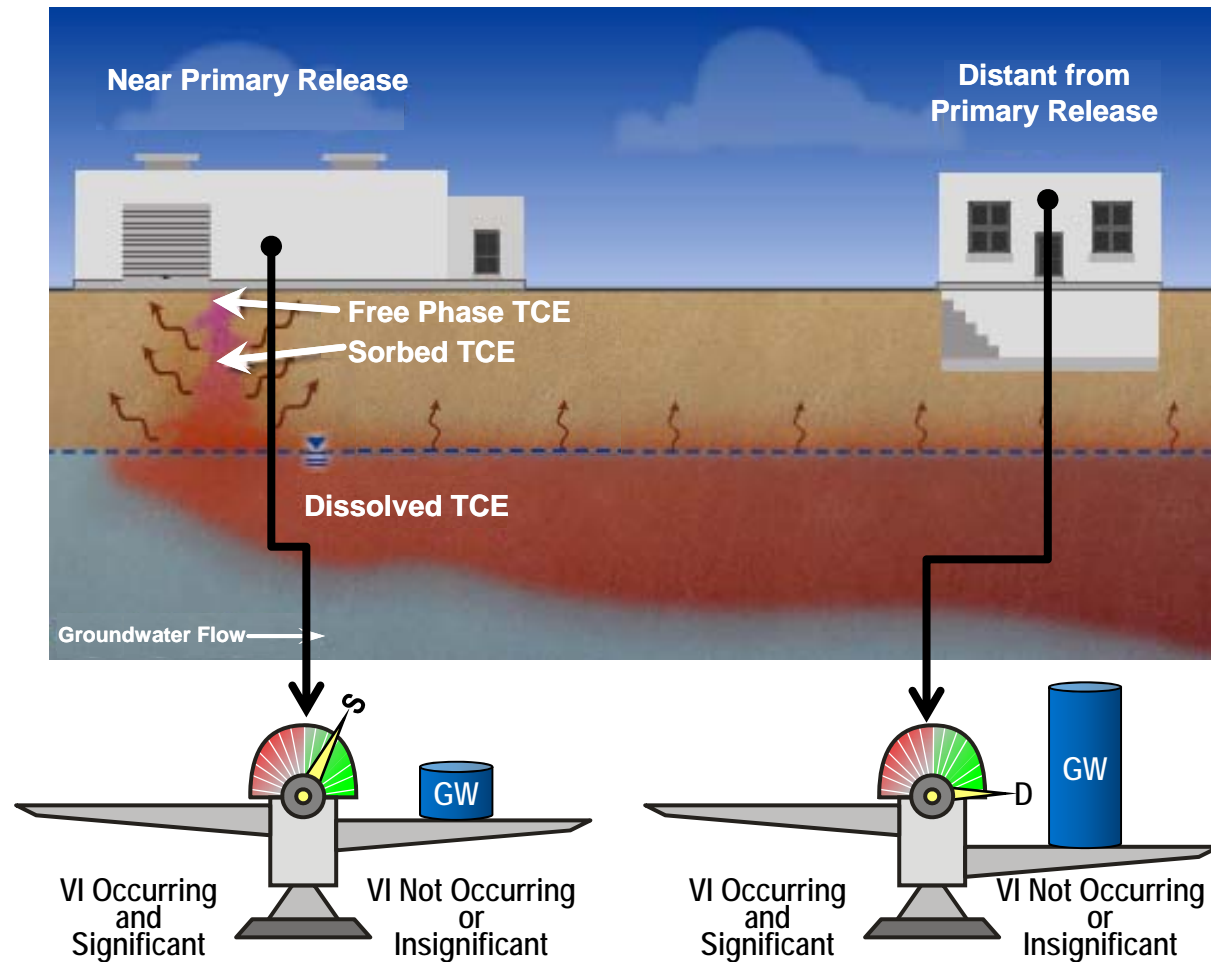
Evolution of the VI Practice Ahead of Guidance

Non-Linear Approach
2011

- Simultaneously Weigh Multiple Lines of Evidence
- Understand Evidence Strengths/Limitations
- Strong Focus on Conceptual Site Model

Subslab Soil Gas Data

Exterior Groundwater and Soil Gas Data

Site/Building History

Subsurface Characteristics

Navy VI Tool

Building Characteristics, Occupancy and Use

Indoor Air Data

Background Sources

S/D

GW

IA

VI Occurring and Significant

VI Not Occurring or Insignificant

Other considerations
- Intrusiveness
- Ownership/Access
- Mission Needs
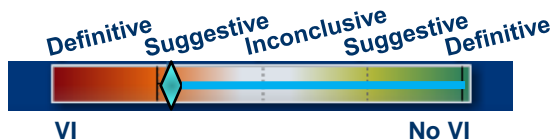- Sustainability
- Schedule, Cost

# Key Concept of Tool: Strength of Evidence Depends on CSM

Strength of Evidence – Groundwater & Soil Gas
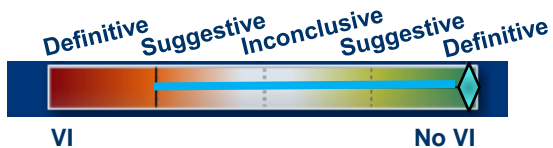
- Determining the strength of groundwater or soil gas data as a line of evidence

- Concentrations > SL only <u>suggestive</u> that VI <u>is occurring</u> because it is predictive

- Can be <u>definitive</u> that VI <u>is not</u> occurring when:
  - Groundwater is the only vapor source
  - Levels at or near water table are below SL
 - Site is well characterized at the water table
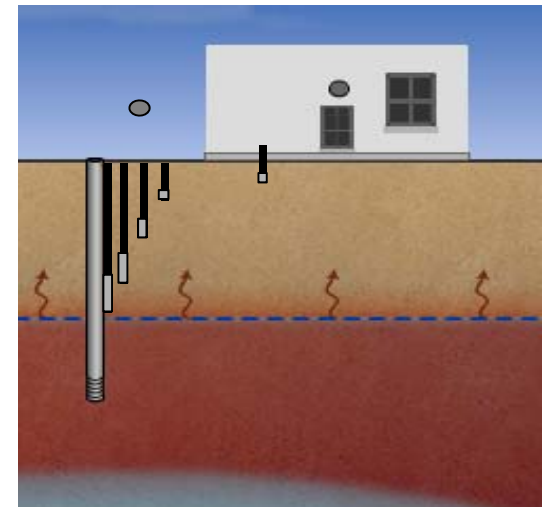
Strength of Evidence – Indoor Air

- IA $< SL_{IA}$ – Suggestive to definitive VI not occurring or insignificant
  - Suggestive with limited spatial/temporal coverage
  - Definitive with adequate CSM and spatial/temporal indoor air data

Definitive   Suggestive   Inconclusive   Suggestive   Definitive

VI   No VI

Strength of Evidence – Indoor Air

- IA > SL$_{IA}$ – Depends on results of the background evaluation
  - Indoor > screening level and no background evaluation performed (inconclusive to suggestive of VI)
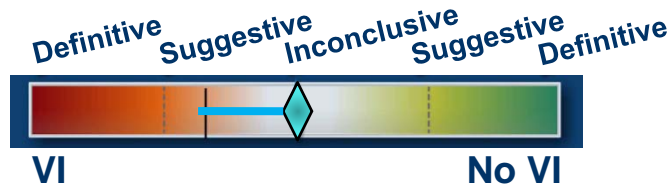
  - Indoor > screening level and background evaluation concludes background source (suggestive to definitive no VI)

Strength of Evidence – Indoor Air

– Indoor > screening level and background evaluation concludes no background source (suggestive to definitive of VI)

Definitive Suggestive Inconclusive Suggestive Definitive

VI   No VI

KEY POINT: Exceedance of screening level and "Significant" does not mean unacceptable risk or mitigation action is required

Example Case Study: MCAS Cherry Point

- Large industrial area (**565 acres**)

- Multiple sources contribute to chlorinated-VOC groundwater plumes
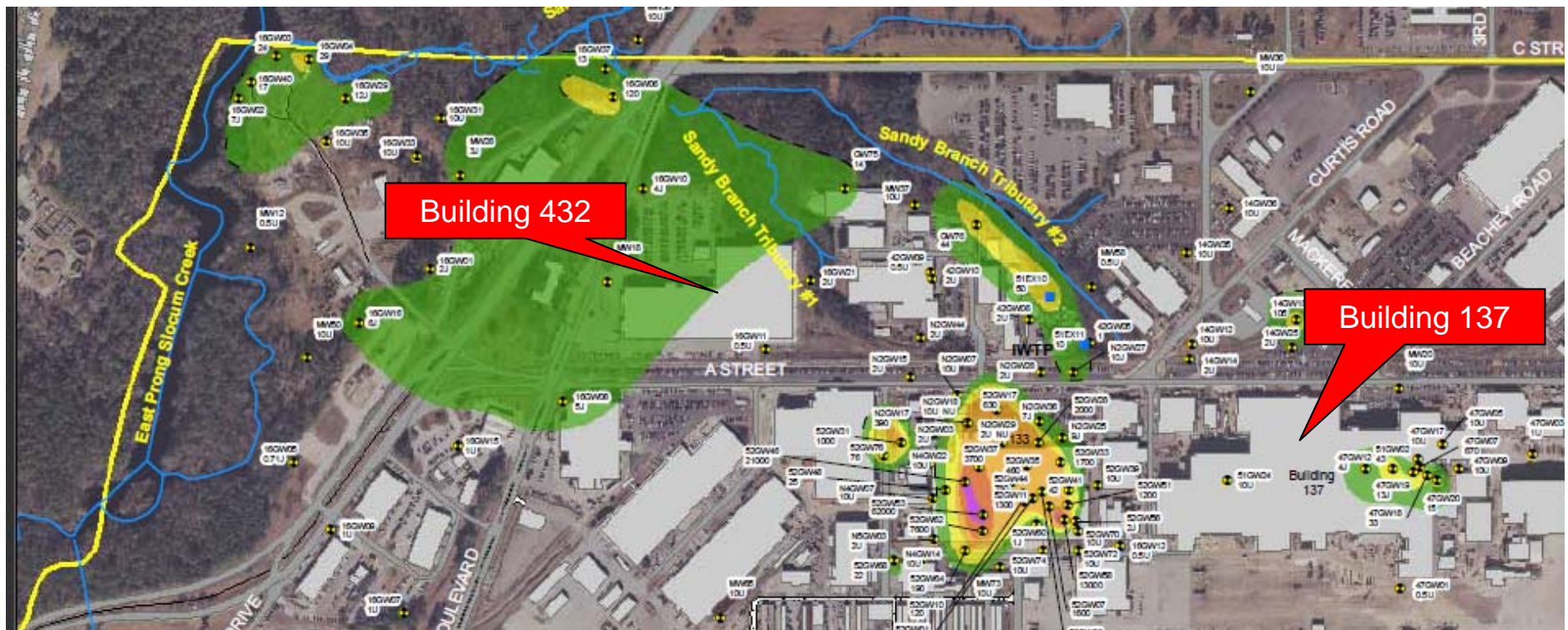
Example Case Study: MCAS Cherry Point

- VOC concentrations suggestive of free phase TCE

- Depth to GW is 4 to 21 ft bgs

- Wells screened at multiple depths
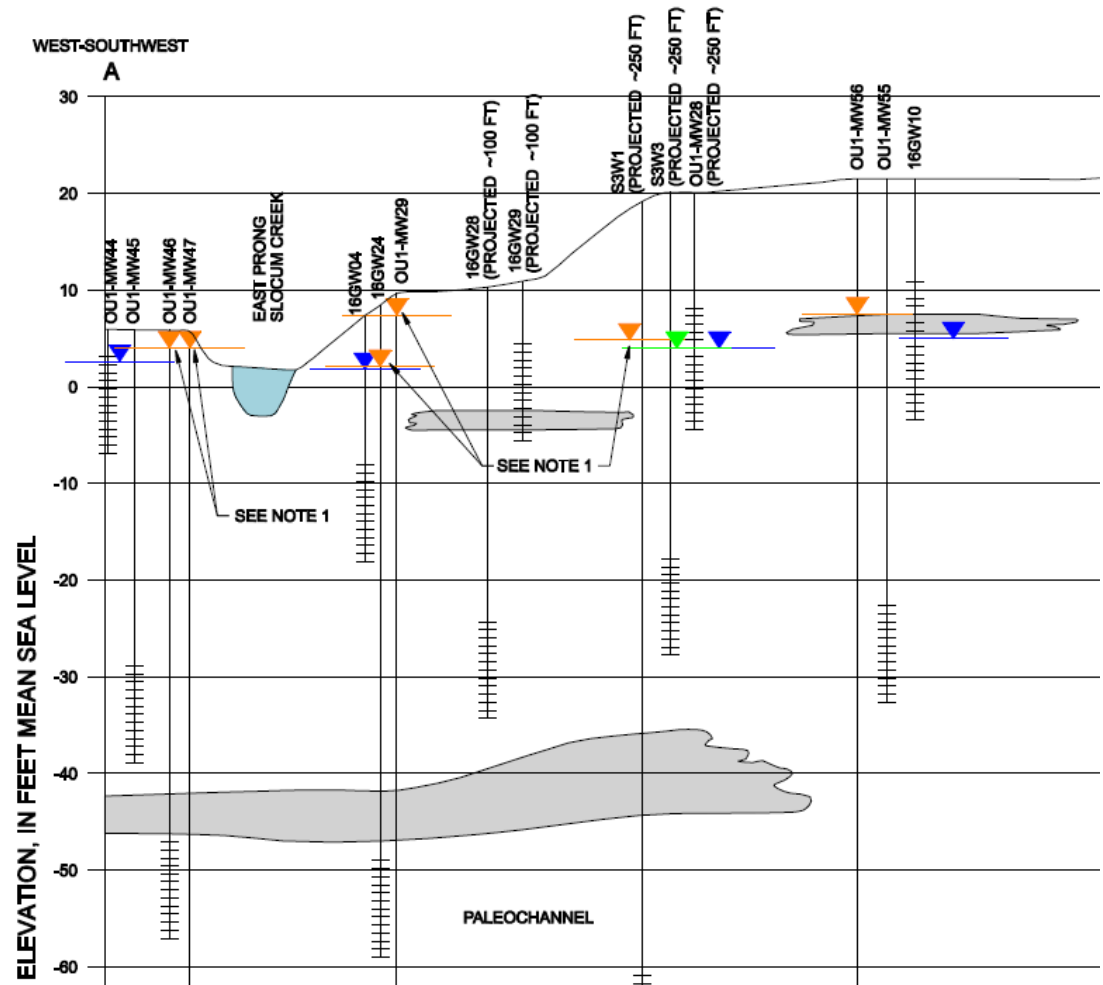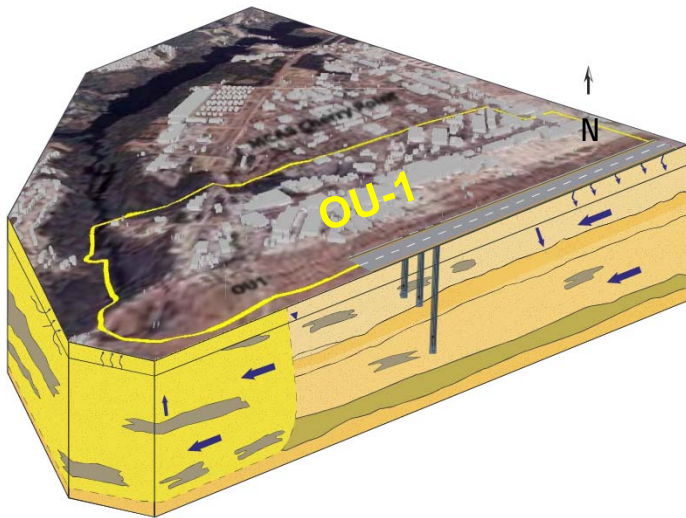
Navy VI Assessment Tool: Live Demonstration
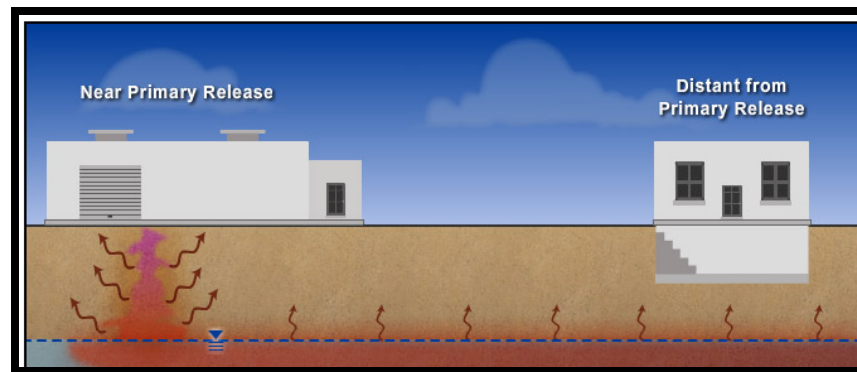
Water Table and Soil Gas Results Above Capillary Fringe Near Bldg. 4032

Evaluation of Subslab Soil Gas Data at Bldg. 137

Building ID: Building 137
Scenario: Current Building Near Primary Release
Investigative Strategy: Subslab Soil Gas Data

TCE Concentrations in Groundwater

Subslab Soil Gas Sampling Locations

Subslab Soil Gas Results at Building 137

OU1-51NS04-4.5-5.5-09D

COPC	Concentration (μg/m³)
1,1,1-TCA	100
1,1,2,2-PCA	5.5 U
Freon-113	12
Methylene chloride	9.9
VC	2.5

OU1-51NS03-6-7-09D

COPC	Concentration (μg/m³)
Freon-113	31
Methylene chloride	14
TCE	2.3
VC	92

OU1-51TW04-09D

COPC	Concentration (μg/L)
No cVOCs detected above SLs	

OU1-51TW03-09D

COPC	Concentration (μg/L)
1,1-DCA	4.8

OU1-51SG02-09D

COPC	Concentration (μg/m³)
1,1,1-TCA	10,000
1,1,2,2-PCA	24 U
1,1-DCA	3,700
1,1-DCE	1,200
Methylene chloride	72
PCE	38
trans-1,2-DCE	38
TCE	3,100

OU1-51NS06-5-6-09D

COPC	Concentration (μg/m³)
1,1,1-TCA	12
1,1,2,2-PCA	5.5 U
Freon-113	13
VC	4.6

OU1-51SG03-09D

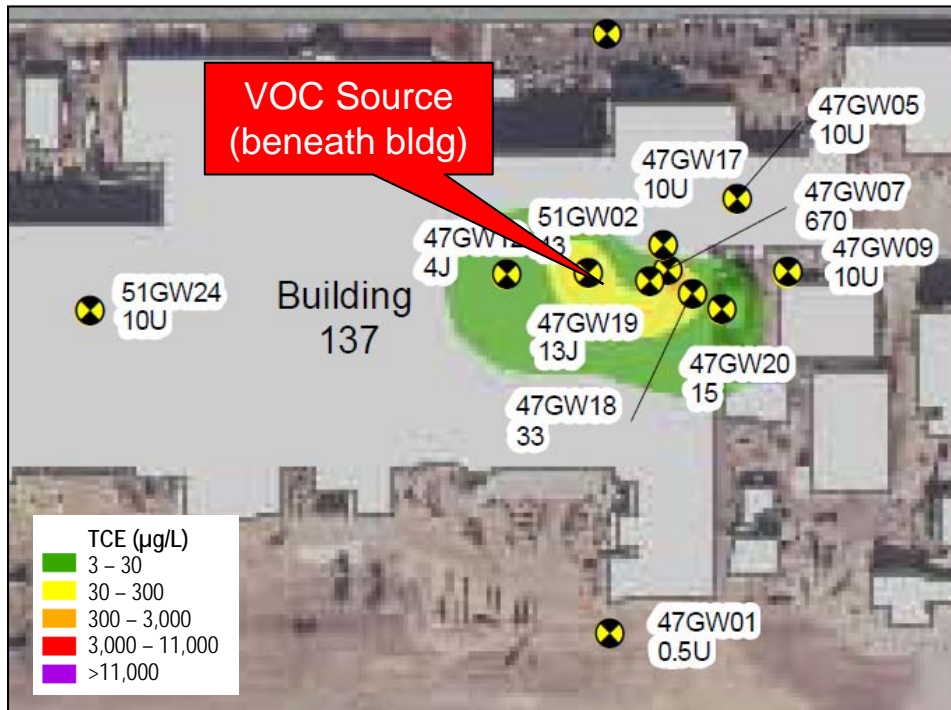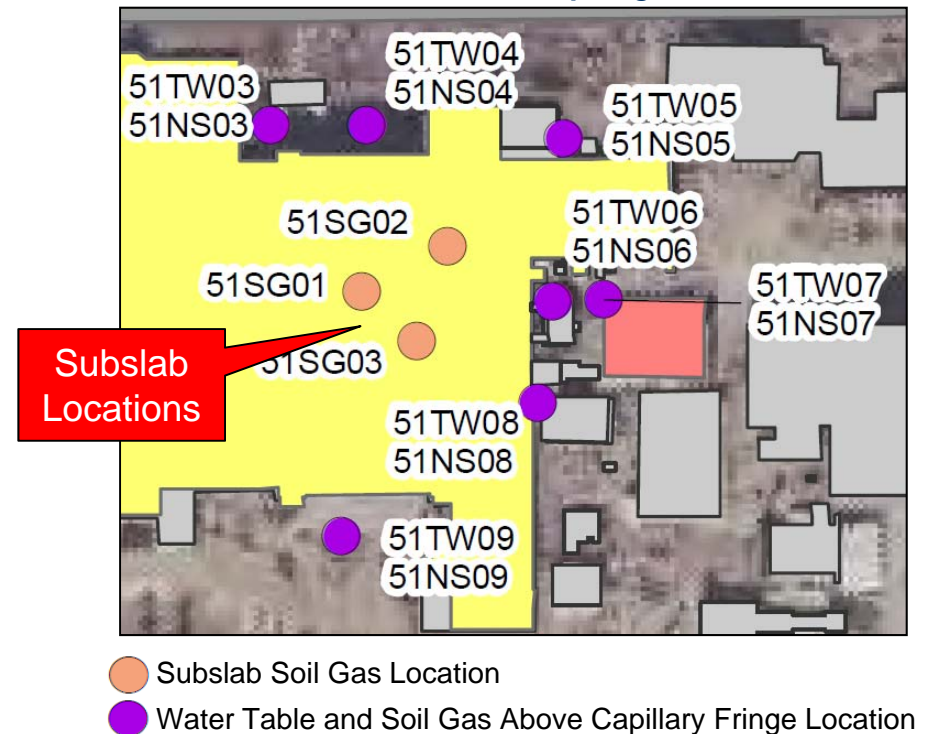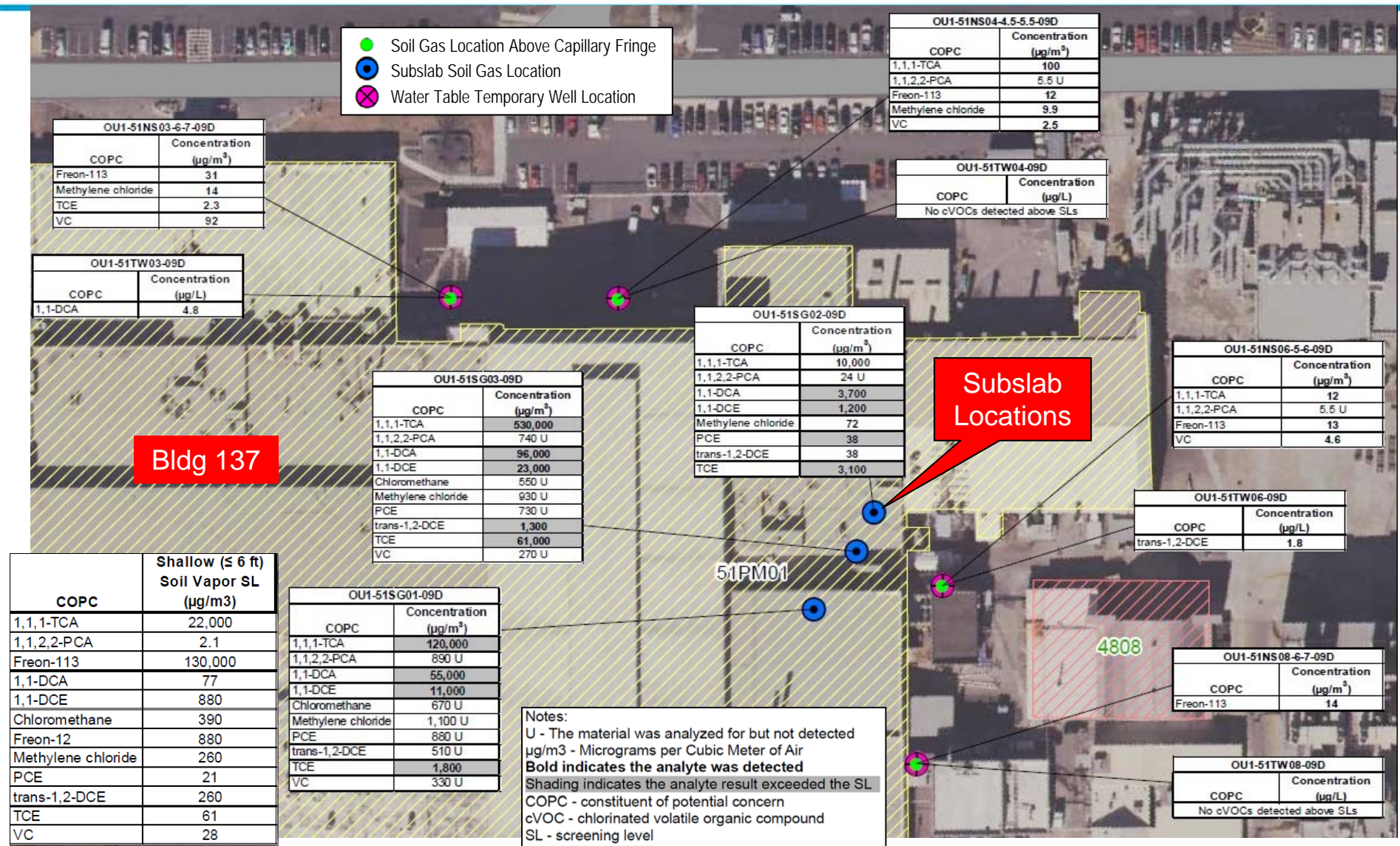| COPC	Concentration (μg/m³)
1,1,1-TCA	530,000
1,1,2,2-PCA	740 U
1,1-DCA	96,000
1,1-DCE	23,000
Chloromethane	550 U
Methylene chloride	930 U
PCE	730 U
trans-1,2-DCE	1,300
TCE	61,000
VC	270 U

Subslab Locations

Bldg 137

OU1-51TW06-09D

COPC	Concentration (μg/L)
trans-1,2-DCE	1.8

51PM01

4808

COPC	Shallow (≤ 6 ft) Soil Vapor SL (μg/m3)
1,1,1-TCA	22,000
1,1,2,2-PCA	2.1
Freon-113	130,000
1,1-DCA	77
1,1-DCE	880
Chloromethane	390
Freon-12	880
Methylene chloride	260
PCE	21
trans-1,2-DCE	260
TCE	61
VC	28

OU1-51SG01-09D

COPC	Concentration (μg/m³)
1,1,1-TCA	120,000
1,1,2,2-PCA	890 U
1,1-DCA	55,000
1,1-DCE	11,000
Chloromethane	670 U
Methylene chloride	1,100 U
PCE	880 U
trans-1,2-DCE	510 U
TCE	1,800
VC	330 U

Notes:
U - The material was analyzed for but not detected
μg/m3 - Micrograms per Cubic Meter of Air
Bold indicates the analyte was detected
Shading indicates the analyte result exceeded the SL
COPC - constituent of potential concern
cVOC - chlorinated volatile organic compound
SL - screening level

OU1-51NS08-6-7-09D

COPC	Concentration (μg/m³)
Freon-113	14

OU1-51TW08-09D

COPC	Concentration (μg/L)
No cVOCs detected above SLs	

Legend:
● Soil Gas Location Above Capillary Fringe
◉ Subslab Soil Gas Location
⊗ Water Table Temporary Well Location

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Questions?